

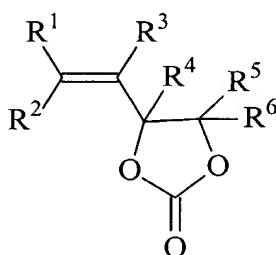
SUPPORT FOR THE AMENDMENTS

Claims 4-6 have been amended for clarity. Claim 11 has been amended to specify the amount of the vinylethylene carbonate represented by formula (I). That amendment and newly-added Claims 14-19 are supported by the specification at pages 5-28. No new matter is believed to have been added to the present application by the amendment submitted above.

REMARKS

Claims 1-19 are pending. Favorable reconsideration is respectfully requested.

The present invention relates to a non-aqueous electrolyte secondary battery comprising a negative electrode, a positive electrode and an electrolyte having a lithium salt dissolved in a non-aqueous solvent, wherein the non-aqueous solvent comprises a vinylene carbonate compound represented by the following formula (I) *in an amount of from 0.01% to 20% by weight*:



See Claim 1.

The present invention also relates to a non-aqueous electrolyte for a non-aqueous electrolyte secondary battery comprising a solute and a non-aqueous solvent, wherein the non-aqueous solvent comprises the vinylene carbonate compound represented by formula (I) in an amount of from 0.01 to 20% by weight. See Claim 10.

Independent Claim 11 is directed to a non-aqueous electrolyte. As amended above, that claim also specifies that the non-aqueous solvent comprises the vinylene carbonate compound represented by formula (I) in an amount of from 0.01 to 20% by weight.

At the outset, Applicants would like to thank Examiner Weiner for the helpful and courteous discussion held with their representative on September 1, 2004.

During the discussion, Applicants' representative pointed out that Claims 1 and 10 specify the amount of the vinylene carbonate compound represented by formula (I) as a % by weight. It was also explained that dependent Claim 4 is directed to an embodiment of the invention in which the non-aqueous solvent is a mixed solvent comprising two additional

components (a) and (b), where each of (a) and (b) is not less than 20-% by volume, and where the total amount of (a) and (b) is not less than 70vol-% based on the total volume of the solvent. It is important to note that (a) and (b) are not the same as the vinylethylene compound represented by formula (I). Thus, in the battery recited in Claim 4, the non-aqueous solvent comprises 0.01% to 20% by weight of the vinylethylene compound represented by formula (I), as recited in Claim 1, and not less than 70vol-% based on the total volume of the solvents (a) and (b) in total. Accordingly, Claim 4 does not modify the amount of the vinylethylene compound represented by formula (I) in the solvent.

During the discussion, the Examiner expressed concern that Claim 1 recites a component of the solvent as % by weight but Claim 4 specifies components of the solvent in terms of vol-%. In this art, it is common to describe the amount of a “major solvent” in terms of vol-% and an “additive” in terms of % by weight, just as is done in the present specification. The following remarks expand on the discussion with the Examiner.

Applicants would like to thank Examiner Weiner for indicating that Claims 2-4, 8, 11 and 13 are allowable. Favorable reconsideration of all of the pending claims is respectfully requested at this time.

The rejection of Claims 1, 5-7, 9-10 and 12 under 35 U.S.C. §102(b) over Yoshimura et al. is respectfully traversed. The reference fails to disclose the claimed non-aqueous electrolyte secondary battery and electrolyte.

Yoshimura et al. discloses a nonaqueous electrolytic cell that contains a solvent. See page 1, bottom, of the translation. The Examples of that patent describe a solvent containing an equal volume of vinylethylene carbonate (VEC) and 1,2-dimethoxyethane (DME). See, for example, the paragraph bridging pages 3-4. Thus, the solvent described by Yoshimura et al. contains 50% by volume of vinylethylene carbonate.

The specific gravity of VEC and DME is  $1.188 \text{ g/cm}^3$  and  $0.867 \text{ g/cm}^3$ , respectively. Thus, converting from % by volume to % by weight, i.e., VEC:DME = 57.8:42.2 (weight percent), demonstrates that the Examples in Yoshimura et al. contain 57.8% by weight of VEC.

In contrast, Claims 1 and 10 specify that the solvent contains from 0.01% to 20% by weight of the vinylethylene carbonate compound represented by the formula (I). The amount of vinylethylene carbonate in the solvent described by Yoshimura et al. is much higher than 20% by weight: 50% by volume, i.e., 57.8% by weight. Therefore, the reference fails to describe a non-aqueous electrolyte secondary battery or electrolyte within the scope of the claims of the present application. Nor does the reference suggest such a battery.

In addition, Applicants submit herewith an executed Rule 132 Declaration of Minoru Kotato, an inventor in the present application.

As described in paragraph (3) of the Declaration, batteries were prepared in the same manner as in Example 1 of the present application, except that the content of vinylethylene carbonate (VEC) was 5% by weight, 10% by weight, 50% by weight or 100% by weight, respectively (5% by weight of VEC corresponds to Example 1 of the present application). The remainder of the electrolyte solvent was propylene carbonate, i.e., in the batteries where the amount of VEC was less than 100% by weight.

In addition, a battery was prepared in the same manner as in Example 1 of the present application, except that the solvent composition in Example 1 of Yoshimura et al. was used, i.e., an equal volume of VEC and 1,2-dimethoxyethane (DME). In this electrolyte, lithium hexafluorophosphate ( $\text{LiPF}_6$ ) was used instead of the lithium trifluoromethanesulfonate described in Example 1 of Yoshimura et al.

The batteries were subjected to testing in the same manner as in the Examples of the present application.

In the case that the content of vinylethylene carbonate (VEC) is 5% by weight, 10% by weight, 50% by weight or 100% by weight, respectively, and a mixed solvent containing VEC and DME with an equivalent volume is used, capacity-potential curves involved in charge-discharge at the first cycle are shown in Figs. A, B, C, D and E, respectively, attached to the Declaration.

In case that the content of vinylethylene carbonate (VEC) is 5% by weight, 10% by weight, 50% by weight or 100% by weight, respectively, and a mixed solvent containing VEC and DME with an equivalent volume is used, dedoped capacity and efficiency at the first cycle are shown in Table A at page 3 of the Declaration. Table A is reproduced below for convenience.

As storage property, in case that the content of vinylethylene carbonate (VEC) is 5% by weight, 10% by weight, 50% by weight or 100% by weight, respectively, and a mixed solvent containing VEC and DME with an equivalent volume is used, the percentage of developed capacity after storage to developed capacity before storage is shown in Table B at page 3 of the Declaration. Table B is reproduced below for convenience.

Table A

	Dedoped capacity at 1 <sup>st</sup> cycle (mAh/g)	Efficiency at 1 <sup>st</sup> cycle (%)
5 wt% VEC	329	91.9
10 wt% VEC	321	91.7
50 wt% VEC	-	-
100 wt% VEC	-	-
VEC:DME=1:1	208	88.0

Table B

	Storage properties (%)
5 wt% VEC	97.4
10 wt% VEC	95.0
VEC:DME=1:1	80.1

As shown in Figs. C and D of the Declaration, when the content of vinylethylene carbonate (VEC) is 50% by weight or 100% by weight, respectively, a flat portion was observed in the vicinity of 1.4 V, and degradation of vinylethylene carbonate proceeded, and it was impossible to dope by 0 V.

The results presented in the Declaration demonstrate that a battery containing an amount of VEC within the amount claimed has superior properties as compared to a battery containing equal amount of VEC and DME as described in Yoshimura et al. One with that reference in hand would not have been able to predict such a result. There is no suggestion in Yoshimura et al. that a battery containing 20% by weight or less of VEC as claimed would be superior to a battery containing 50% by weight of VEC. Accordingly, the data presented in the Declaration are convincing evidence of the non-obviousness of the claimed invention.

Based on the foregoing, withdrawal of this ground of rejection is respectfully requested.

Applicants submit that the present application is in condition for allowance. Early notice to this effect is earnestly solicited.

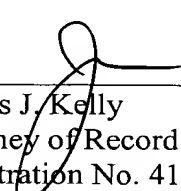
Respectfully submitted,

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